OBSERVATIONS ON *ONCHOCERCA VOLVULUS*

BY

J. W. S. MACFIE

AND

J. F. CORSON

(*Received for publication* 28 *November*, 1922)

The following brief and somewhat disconnected notes on *Onchocerca volvulus* are based on observations made at Accra in the Gold Coast, West Africa.

DIAGNOSIS. The tumours of *O. volvulus* are by no means always large and easily recognisable, but are frequently very small, deep-seated, and difficult to detect. In some cases, indeed, we have been able to palpate them only after they had been located for us by the patients themselves. The diagnosis of volvulosis by the presence of tumours is, therefore, unreliable, and we have found it more satisfactory to examine the skin for larvae.

The method we adopt is to remove from the lower part of the back a small piece of skin similar to, but rather larger than, those used in skin-grafting by Reverdin's method. The skin is raised with the point of a needle, and a piece of the required size snipped off with a pair of sharp scissors. The pieces of skin may be examined immediately by teasing them on a slide with a little normal saline solution, or they may be left for an hour or two in saline solution in small tubes, in which case the larvae will be found to have worked their way out and to be lying at the bottom, or they may be used for sectioning. The technique is simple and rapid, and as it is not painful and is not objected to by African patients, is capable of wide application. The little wounds heal rapidly.

In such pieces of skin removed from patients with *O. volvulus* tumours we have invariably found larvae. In the one or two apparent exceptions met with, the tumours on removal proved to be juxta-articular nodules, and not *O. volvulus* tumours. In many other cases in which no tumours could be found, the pieces of skin removed in this way contained *O. volvulus* larvae.

As regards 'lichenification' and the other skin conditions

sometimes considered to be due to volvulosis, we have on the one hand observed them in skin in which no larvae were found, and on the other hand found larvae abundantly present in apparently normal skin. Moreover, we have recently found another filarial larva in the skin which, at Accra at any rate, is even more commonly present than that of *O. volvulus*. In view of this discovery, further observations are necessary before it can be said if either of the two larvae is responsible for the lesions.

INCIDENCE. In order to obtain some idea of the prevalence of *O. volvulus* infection in the Gold Coast, fifty men, taken at random, were examined at Accra, all of whom were adults, between the ages of 25 and 45 years, who appeared to be in good health. The examinations were made on the 24th of October, 1922, between the hours of 9.45 and 10.15 a.m.

From each man a small piece of skin, as described above, was removed from the small of the back and placed in a tube containing about 2 c.c. of normal saline solution. The piece of skin was subsequently teased up together with a drop or two of the saline solution from the bottom of the tube, the preparation fixed by heating, dried, and stained with haemalum. In no case was there obvious blood in the specimen.

The result of this examination was that larvae of *O. volvulus* were found in seventeen of the men (equal to 34 per cent.).

PERIODICITY. Ten of the men referred to above, in whom larvae had been found, were re-examined two days later at about 9 p.m. No sensible difference was observed suggestive of a periodicity in the prevalence of the larvae in the skin. This observation is in harmony with that of Montpellier and Lacroix (1920).

DISTRIBUTION OF THE LARVAE IN THE BODY. In most of the cases examined we have sought for the larvae of *O. volvulus* in the skin of the lumbar region or the small of the back only. In a few instances, however, we examined other parts also; for example, in a Kru man with a small tumour in the left inguinal region, larvae were found abundantly in the skin of the left buttock, the right ankle, the right shoulder cap, and the right wrist. Our observations, indeed, showed clearly that even in subjects in whom no tumours could be detected and whose skin was normal, larvae of *O. volvulus* might be found in the skin of widely separated regions of the body.

TABLE

The distribution of *O. volvulus* larvae in the body.

Parts of the body examined	I Kru man, c. 25	II Ashanti man, c. 40	III Ashanti man, c. 40
Skin of scalp : left occipital region ...	nil	—	—
above the right ear ...	—	—	nil
Skin, behind the left ear	—	*mf. v.* numerous	—
Skin : right wrist	—	—	nil
left wrist	*mf. v.* numerous	—	—
Skin, second finger of right hand ...	—	nil	—
Skin, small of back	*mf. v.* numerous	*mf. v.* few	*mf. v.* numerous
Skin, scrotum	—	—	*mf. v.* few
Skin : right ankle	*mf. v.* numerous	*mf. v.* numerous	—
left ankle	—	—	*mf. v.* numerous
Mucous membrane of mouth, lower lip...	nil	nil	nil
Stomach	nil	nil	—
Small intestine	nil	nil	—
Large intestine	nil	nil	—
Rectum	—	—	nil
Mesentery	nil	nil	nil
Parietal pleura, 8th interspace	nil	nil	—
Intercostal muscle, 8th interspace ...	nil	—	—
Lung	nil	nil	nil
Heart, left ventricle	nil	nil	—
Aorta	nil	nil	nil
Peritoneum...	nil	nil	—
Liver	nil	nil	nil
Spleen	nil	nil	nil
Kidney	nil	nil	—
Bladder	nil	nil	—
Brain : cerebral cortex	—	—	nil
cerebellum	—	—	nil
Lymphatic glands : near aorta	nil	—	nil
mesenteric	nil	nil	nil
inguinal	nil	—	nil

mf. v. = larvae of *Onchocerca volvulus*.
nil = no larvae found.
— = not examined.

In order to ascertain more accurately the distribution of the larvae in the body, three natives were examined particularly in the mortuary, the first a Kru man, aged about 25 years, and the second and third Ashanti men, aged about 40 years. The first two men had died from pulmonary tuberculosis, and the third from cerebral congestion. No tumours were found in any of the three, and no definite skin lesions of the types associated with volvulosis, excepting in the third man, who had slight 'lichenification' of the back.

The various parts of the body examined, and the results, are shown in the accompanying table. About 0·25 c.c. of each tissue was examined. It will be noted that larvae were found in the skin of widely separated areas, but that they were not found in any of the mucous membranes or organs.

During the autopsies a careful search for adult worms was made in the mesentery and the retro-peritoneal tissue in the neighbourhood of the liver, the duodenum, and the aorta, but none were found. The inner surface of the aorta (in view of the fact that *O. armillata* is abundant in this situation in cattle at Accra), and a number of lymphatic glands from the mesentery, the inguinal region, and near the aorta were also examined without success.

Larvae are not found in Sweat. Although the larvae of *O. volvulus* are abundant in the skin, they do not appear in the sweat. One of the laboratory staff, a Mendi, in whose skin larvae were numerous, was set to work in the sun until he perspired freely. Sweat was then collected from his face, chest, abdomen and back, and examined for larvae. None were found.

Experiments with Tsetse-Flies. Leiper (1913) failed to trace any development of the larvae of *O. volvulus* in *Stemoxys calcitrans* and *S. nigra*, and Rodhain and Van den Branden (1916) failed with *Stegomyia fasciata* and *Cimex rotundatus*. Brumpt has suggested that the larvae may develop in a tsetse-fly, but so far as we are aware, no observations have yet been recorded in support or otherwise of this view. A few experiments were, therefore, carried out at Accra, in which wild tsetse-flies were fed on patients in whose skin *O. volvulus* larvae were abundant, and subsequently dissected and examined for developmental stages of these parasites. Unfortunately for our purpose Accra is situated in an extensive

tsetse-free area, and we were, therefore, able to procure only a few living flies for our experiments.

Glossina palpalis, R. D. Three flies were fed once only on a case of volvulosis and dissected, two on the sixth day, and one on the seventh day after the infecting feed. No filarial larvae were found. Ten specimens which had not been fed experimentally were also dissected as a control. No filarial larvae were found in them.

G. longipalpis, Wied. Six flies were fed once only on a case of volvulosis and dissected, two on the twelfth day, and one each on the second, fourth, fifth and sixteenth days after the infecting feed. No filarial larvae were found. Fifteen specimens which had not been fed experimentally were also dissected as a control. No filarial larvae were found in them.

These few observations do not support Brumpt's suggestion, so far, at any rate, as concerns *G. palpalis* and *G. longipalpis*. The number of flies employed was, indeed, regrettably small, but if volvulosis is as prevalent as the figures we have given suggest, and if the parasites are able to develop in them, it might have been expected that one or two of these tsetse-flies (including the controls) might have shown them.

Experiments with Lice. From the usual position of the larvae in the skin, namely, close under the rete mucosum, we are inclined to think that the intermediate host, if indeed it is a biting insect, will prove to be one which does not probe the skin deeply. Lice at once suggest themselves, but so far as our observations have at present proceeded we are not able to incriminate them. One of us (J. F. C.) dissected about sixty specimens of *Pediculus humanus corporis* at Sekondi without finding any filarial larvae, and further dissections (forty-six) at Accra have been equally fruitless. Moreover, twenty lice taken from the bodies of two men not infected with *O. volvulus* and fed on a man who harboured larvae of *O. volvulus* in his skin, and larvae of *Acanthocheilonema perstans* in his blood, were dissected an hour later. Larvae of *O. volvulus* were not found in any of them, but living and active larvae of *Ac. perstans* were observed in eight. This experiment suggests that the lice, in feeding, draw up the larvae present in the blood of their host, but not those in his skin. It may be added that in several of the lice dead and partly digested larvae of *Ac. perstans* were found

(derived, presumably, from some previous host), an observation which confirms that of Low (1903), who failed to trace development of this worm in *P. capitis* and *P. vestimentorum*.

From the fact that the larvae are particularly numerous in the skin at the base of the trunk (buttocks, scrotum, &c.), *Phthirius pubis* might be regarded as a likely host. Contrary to expectation, these creatures have proved difficult to obtain at Accra, and we have not yet been able to procure any for dissection and experiment.

REFERENCES

Leiper, R. T. (1913). Report of the Helminthologist, London School of Tropical Medicine, for the Half-year ending April 30th, 1913. *Report to the Advisory Committee of the Tropical Diseases Research Fund.*

Low, G. C. (1903). *Filaria perstans. Jour. Trop. Med. & Hyg.*, Vol. VI, p. 199.

Montpellier, J., and Lacroix, A. (1920). Le Craw-craw ou gale filarienne; son origine dans les kystes sous-cutanés à *Onchocerca volvulus*. *Bull. Soc. Path. Exot.*, Vol. XIII, pp. 305-315.

Rodhain, J., and Van den Branden, F. (1916). Recherches diverses sur la *Filaria* (*Onchocerca*) *volvulus*. *Bull. Soc. Path. Exot.*, Vol. IX, pp. 194-196.